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Original article

Effect of various husbandry conditions on the production parameters of swine herds in Poland

A. Dors[1], E. Czyżewska[1], M. Pomorska-Mól[1], R. Kołacz[2], Z. Pejsak[1]

[1] Department of Swine Diseases, National Veterinary Research Institute, Partyzantów 57, 24-100 Pulawy, Poland
[2] Department of Genetics and Animal Breeding, Wroclaw University of Environmental and Life Sciences, C.K. Norwida 25/27, 50-375 Wroclaw, Poland

Abstract

The aim of this study was to collect production data of Polish swine herds, with special emphasis on the production parameters in farrow to finish pig herds. Another goal was to determine differences in the production performance of swine herds with different sizes, various status with regard to biosecurity, and with different veterinary expenditure. For this purpose, questionnaire surveys were carried out in 96 polish farrow to finish pig herds. The data concerning production parameters (e.g. the number of pigs born per sow per year, litters per sow per year, pre- and post-weaning mortality), farm size (small, medium, large), management (all in-all out by room or building), veterinary expenditure (including medication) and the percentage of pigs under medical treatment, were collected.

The data obtained in the present study indicate that in general, the efficiency of swine production in evaluated farms was relatively low. It was also found that in large swine farms the efficiency was better than that in small ones and that the proper biosecurity positively influenced the performance of the swine farms. However, only in 10.4% facilities, the biosecurity rules and methods, including the principle "all-in all-out", were implemented and kept. It seems that inefficient swine production on the majority of Polish farms results from poor basic knowledge on pig production and understanding of fundamental economic rules of swine breeding.

Keywords: pig performance, production effectiveness, management practices, veterinary expenditure, Poland

Introduction

During the last 7 years (since 2006) the production of fatteners in Poland has been rapidly decreasing, which also coincided with even greater reductions in the number of sows (Fig. 1). The number of sows dropped from 1.786 million to 1.012 million and the number of slaughtered fatteners from 18.813 million to 11.128 million (GUS 2012b). The reasons for the falling numbers are highly differentiated (Pejsak 2012). One of them seems to be unprofitable production of piglets and fatteners, being a consequence of

Correspondence to: A. Dors, e-mail: arkadiusz.dors@piwet.pulawy.pl

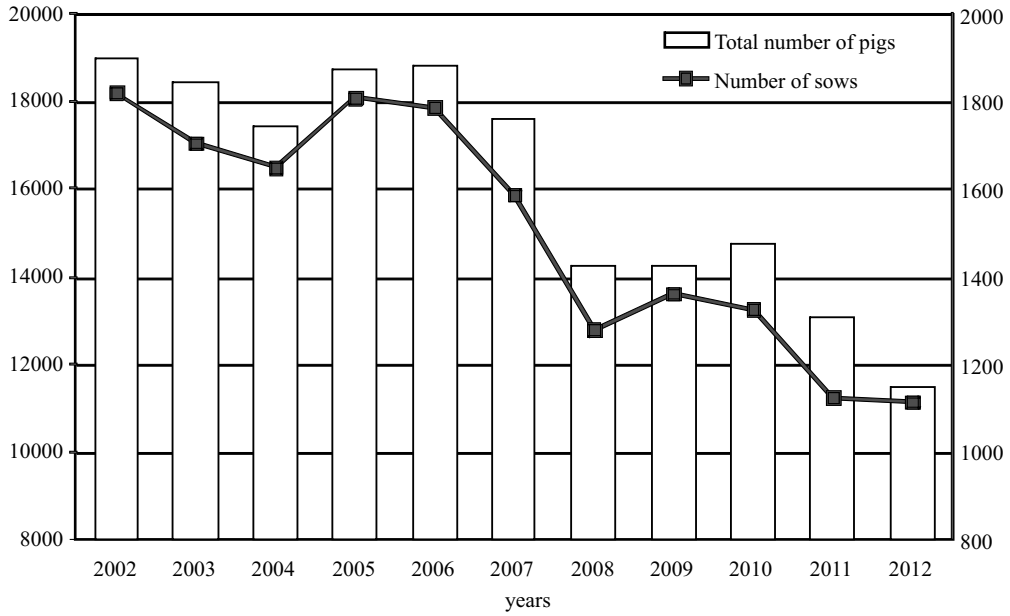

Fig. 1. The total number of pigs and sows (x 1,000 heads) in 2002-2012 in Poland (Source: GUS 2012b).

Table 1. Selected data of pig productive parameters as reported by GUS, POLSUS and the Institute of Animal Husbandry (Source: BPEX 2010, Blicharski 2012, GUS 2012a).

Year	2011	2002	2011
Source of data	GUS*	Institute of Animal Husbandry **	POLSUS***
Pigs born per sow per year	16.3	21.21	24.76
Pigs weaned per sow per year	15.35	19.13	22.44
Pigs sold per sow per year	14.46	18.19	N/A
Litters per sow per year	N/A	1.96	2.12
Pigs born alive per litter	N/A	10.82	11.68
Pre-weaning mortality (%)	5.80%	9.80%	9.37%
Post-weaning mortality (%)	5.80%	4.90%	N/A

* – data of the total pig population in Poland
** – data of 420 commercial herds
*** – data of Polish White Lop-eared seedstock herds
N/A – no data available

low reproduction performance of the Polish breeding herd, considerable losses of piglets and high feed conversion rates.

The statistical data reported by the Central Statistical Office (Polish abbreviation: GUS) in 2012 show that the mean fertility in breeding herds was 16.3 piglets born alive per sow per year, while the average number of fattening pigs sold per sow per year was 14.46 (GUS 2012a). More reliable data of swine herds seem to be those reported by POLSUS, the Polish Association of Swine Breeders and Producers. These reports show that sow fertility of Polish White Lop-eared sows accounted for 24.76 (Blicharski et al. 2012) (Table 1).The data reported in Poland show great discrepancies as compared to those reported in other EU member-states with well-developed agricultural industry, the US and Canada (NASS 2009, BPEX 2010).

Since the only sources of information are the data reported by GUS, POLSUS and relatively old data reported by the Polish Institute of Animal Husbandry (Table 1), and because a quite large differences between them, the performance of swine herds in Poland requires more extensive investigations. The objective of the present study was to collect a reliable and actual data for the analysis of Polish swine herds

Table 2. The structure of sows herds in relation to the number of sows in breeding herd in 2011 (Source: GUS 2012a).

The number of sows per farm	< 20	20-49	50-99	100-199	200-499	> 500	Total
The number of farms with sows	242,513	7,189	1,396	502	200	99	251,899
The number of sows	800,174	200,893	89,339	65,686	59,440	211,043	1,426,575
Percentages of farms	96.27%	2.85%	0.55%	0.20%	0.08%	0.04%	100.00%
Percentages of sows population	56.09%	14.08%	6.26%	4.60%	4.17%	14.79%	100.00%

performance, with special emphasis on the production parameters of piglets and fatteners in farrow to finish pig herds. The analysis included animal husbandry and veterinary conditions in swine herds.

Materials and Methods

Selection of the pig herds

The herds investigated were selected from a group of 3,500 herds, where veterinary care was provided by specialists of swine diseases. Owners of all those farms were asked for detailed data concerning production parameters of the herds. Unfortunately, only 96 (2.74%) of them had proper and reliable documentation of production. Therefore final number of analyzed farms was 96. They were only farrow to finish pig herds, which kept more than 20 sows in a herd. Surveys were conducted in 2011-2012. The swine herds were kept in barns located in all the voivodships across Poland (Fig. 2). Different housing system and genetic lines have been used in these herds. The selection of the herds was proportional to the number of herds in a given category. Another important factor was the distribution of farms all over Poland (Fig. 2). The herds were categorized according to the sizes: small: from 20 to 49 sows; medium: from 50 to 200 sows and large: over 200 sows. It should be underlined that in 2010 the number of barns with registered sow herds amounted to 251,899, of which 9,386 (3.72%) were registered as herds with more than 20 sows. (Table 2). The selection of the farms with more than 20 sows was made because it was well-known that small swine producers (number of sows less than 20) did not possess detailed records of the production data.

Fig. 2. Distribution of pig herds under investigation.

Questionnaire design

Each farm was visited by a veterinarian and data about farm characteristics were collected using a questionnaire. The data about production parameters, including farm size (small, medium, large), pigs born per sow per year, pigs weaned per sow per year, pigs sold per sow per year, litters per sow per year, pigs born alive per litter, insemination efficiency, pre-weaning mortality, post-weaning mortality, average number of days from birth to slaughter, average live weight at slaughter, sow replacement rate, management (all in-all out by room or building), veterinary expenditure (including medication) and the percentage of pigs under medical treatment, were collected.

Statistical analysis

The data obtained were subjected to the W. Shapiro-Wilk's test of normality and the Levene'a test of equal variances. Normally distributed data with the equal variance were analyzed using the Student's t-test or one-way ANOVA. ANOVA was followed by HSD Tukey's test in the case of significant differences. Additionally, a nonparametric Kruskal-Wallis test with post hoc multiple comparisons for comparison of all pairs was used. For analysis of correlation between measured parameters the Spearman-Rang correlation (nonparametric) were used. Differences with $\alpha < 0.05$ were considered as significant. All calculations were

Table 3. Average values of productive parameters for 96 investigated farrow-to-finish herds in 2011-2012.

	Mean	SD
Pigs born per sow per year	19.40	2.50
Pigs weaned per sow per year	16.79	2.21
Pigs sold per sow per year	15.76	2.16
Litters per sow per year	1.87	0.19
Pigs born alive per litter	10.38	1.10
Insemination efficiency (%)	73.37%	8.13%
Pre-weaning mortality (%)	13.42%	3.47%
Post-weaning mortality (%)	6.17%	1.76%
Average number of days from birth to slaughter (days)	183.7	13.9
Average live weight at slaughter (kg)	109.8	5.8
Sow replacement rate (%)	32.04%	7.36%
Veterinary expenditure per sold fattener (€)	6.66	2.56

SD – standard deviation

Table 4. Production results in swine herds of different sizes.

Number of sows in breeding herd	20-49 (N=56)	50-200 (N=28)	>200 (N=12)
Pigs born per sow per year	18.59[a]	20.19[b]	21.57[b]
Pigs weaned per sow per year	16.14[a]	17.42[b]	18.56[b]
Pigs sold per sow per year	15.16[a]	16.34	17.39[b]
Litters per sow per year	1.82[a]	1.92	2.01[b]
Pigs born alive per litter	10.25	10.52	10.75
Insemination efficiency (%)	71.48%[a]	74.61%	79.84%[b]
Pre-weaning mortality (%)	13.18%	13.74%	13.85%
Post-weaning mortality (%)	6.08%	6.28%	6.32%
Average number of days from birth to slaughter (days)	185.2	183.7	176.2
Average live weight at slaughter (kg)	110.6	109.8	106.0
Sow replacement rate (%)	31.58%	31.92%	34.60%
Veterinary expenditure per sold fattener (€)	6.55	6.5	7.57

[a, b, c] – different letters represent a statistically significant differences between the analyzed parameters.

performed with the Statistica 8.0 (Statsoft, Poland) computer program.

Results

The mean (±SD) values of production parameters for 96 herds under investigation are shown in Table 3. As can be seen in Table 4, the herd size had an impact on the production results, which proved to be better on medium and large farms, than on small ones. As for the reproduction parameters, the greatest, statistically significant, differences were observed in the farrowing index (number of litters per sow per year) ($p<0.05$). This parameter was by 0.19 higher in large herds than in the small herds. Statistically significant differences were also observed in the insemination efficiency ($p<0.05$). In large herds, the insemination efficiency based on the number of farrowings (79.84%) was more than 8% higher than that found in small herds (71.48%).

The data obtained in this study show significant differences in the performance between the farms where the biosecurity rules were applied and those where they did not exist (Table 5). On average, the difference in the number of pigs sold per sow per year was almost 2.5 higher in the herds with proper biosecurity as compared to herds without biosecurity,

Table 5. Production results in herds, where "all in – all out" rule was and was not applied.

All in – all out	Yes (N=10)	No (N=86)
Pigs born per sow per year	21.74	19.09**
Pigs weaned per sow per year	19.00	16.49***
Pigs sold per sow per year	17.93	15.47***
Litters per sow per year	1.97	1.86
Pigs born alive per litter	11.02	10.30*
Insemination efficiency (%)	79.88%	72.49%
Pre-weaning mortality (%)	12.52%	13.54%
Post-weaning mortality (%)	5.63%	6.24%
Average number of days from birth to slaughter (days)	177.6	184.5
Average live weight at slaughter (kg)	107.3	110.2
Sow replacement rate (%)	37%	31.36%
Veterinary expenditure per sold fattener (€)	8.56	6.4**

* $p < 0.05$, ** $p < 0.01$,*** $p < 0.001$ – statistically significant differences between the analyzed parameters.

and reached 17.93 and 15.47 pigs sold per sow per year, respectively. This favorable result coincided with a greater number of pigs born per sow per year (21.74 and 19.09, respectively).

Proper biosecurity was also correlated with expenditure on veterinary services. The data concerning expenditure on veterinary services in the two groups of farms was also surprising, i.e. €8.56 and €6.4, respectively (33.8% higher on farms with biosecurity). This means that the owners applying to the biosecurity rules are ready to cover high veterinary costs because they consider them a necessary investment in animal health and consequently improved production parameters.

The significant positive correlation was found between pigs born/sow/year and pigs sold/sow/year ($r=0.96$, $p=0.000$), pigs weaned/sow/year and pigs sold/sow/year ($r=0.99$, $p=0.000$). Additionally slight negative correlation was found between post-weaning mortality and pigs sold/sow/year ($r=-0.35$, $p=0.001$). There was no significant correlation between pre-weaning mortality and pigs sold/sow/year.

Discussion

The present results clearly show that only a very small percentage of breeders interviewed (2.74% from 3,500) confirmed and after that practically proved that they had adequate documentation of the entire pig production cycle. Biosecurity (including the use of "all-in all-out" procedure during entire production cycle) is another issue underestimated by Polish swine producers. It is well known that only a few of them are aware of the importance of using this method for animal health care. For this reason, an attempt has been done to study to what extent this method has been used by swine breeders and what is its impact on the efficiency of piglet and fattener production. It is worth noting that the range of the actions and reliability of the farms that declared obeying the rules of biosecurity showed great variations. The percentage of ignorant breeders was very high. Only in 10 out of 96 (10.4%) farms, the biosecurity rules and methods, including the principle "all-in all-out", were fully implemented and kept. In this place, worth noting is the fact that the investigation was carried out only in those herds whose owners declared interest in assessment of the health condition of the herd and whose awareness of the importance of this issue was above average.

As can be seen in Table 6, which shows average productive parameters data obtained in 3 EU countries: Austria, Germany and Denmark, and the mean data reported by the EU-15 member states compared with the present results, a number of piglets weaned per sow per year in Poland is less than 6 piglets fewer per year (16.79) than in Austria (22.76), 7 fewer than in Germany (23.90) and almost 10 piglets fewer than in Denmark (26.73). On average, the number of weaned piglets per sow in the EU-15 member states (24.32) is by 6.2 higher than in Poland.

Austria was selected because the swine herd structure in this country is similar to that in Poland and swine farms are primarily family farms (Marquer 2010). Germany was selected due to the highest import rates of fatteners and pork to Poland (Departament Rynków Rolnych 2012). In addition, the weather conditions in Germany and Poland are similar. Denmark was selected because swine breeders in

Table 6. Mean production results in Poland, Denmark, Germany, Austria and average for UE-15 (Source: BPEX 2010, own data).

Country	Poland	Denmark	Germany	Austria	UE-15
Pigs born per sow per year	19.40	31.93	28.06	26.11	27.93
Pigs weaned per sow per year	16.79	26.73	23.90	22.76	24.32
Pigs sold per sow per year	15.76	25.63	22.47	21.70	23.01
Litters per sow per year	1.87	2.25	2.3	2.27	2.28
Pigs born alive per litter	10.38	14.19	12.2	11.5	12.25
Pre-weaning mortality (%)	13.42%	14.00%	14.80%	12.80%	12.90%
Post-weaning mortality (%)	6.17%	6.70%	6.10%	4.70%	5.40%
Average number of days from birth to slaughter (days)	183.70	166.81	197.39	194.76	196.41
Average live weight at slaughter (kg)	109.80	106.66	119.80	119.00	116.89
Sow replacement rate (%)	32%	53.80%	43.20%	37.20%	45.50%

this country are considered the most efficient in Europe and for several years the import of piglets to Poland is growing ever noted. The comparative analysis of the data was based on the data reported by the British Pig Executive (BPEX). The British Pig Executive is a division of the Agriculture and Horticulture Development Board (AHDB). The British Pig Executive is in charge of collecting and processing the data connected with pig production in EU member states and globally, so as to predict the trends and costs connected with English pork and meat products in Britain and globally.

Relevant data for the number of pigs sold per sow per year are as follows. In Poland average number of pigs sold per sow per year was 15.76, while in Austria it was 21.70, in Germany 22.47, in Denmark 25.63 and in EU-15 23.01. This means that a statistical sow in Denmark produces almost 10 piglets more than its counterpart in Poland. When we compare the data recorded in other EU countries with those recorded in Poland, we can see that the difference is 7.5 to the advantage of EU figures. These differences result from a variety of factors. One of them is the annual average number of litters from a sow: 1.87 in Poland; 2.27 in Austria; 2.30 in Germany and 2.25 in Denmark. The average in the EU, excluding Poland is 2.28. It can, therefore, be concluded that annually an average Polish sow produces about 0.4-0.5 fewer litters than an average EU sow. Assuming that the number of piglets per litter in Poland amounts to 10.38, as compared with 11.50 in Austria, 12.20 in Germany and 14.19 in Denmark, we can conclude that this means 5-6 piglets fewer from a sow per year in Poland than in the EU countries. It seems very likely that the main reason for the differences in the number of weaners and the number of sold fatteners is a low farrowing index in Poland resulting from poor management systems, e.g. low replacement rates of the breeding herd (32% on average) as compared with 53.8% in Denmark, 43.2% in Germany and 45.5% in EU member states. These data show that in large extend Polish swine breeders pay too little attention to the advancement in genetics and due to this ignore replacements in the breeding herd. The survey indirectly shows that culling of sows does not take place due to their poor efficiency, but due to their health condition, e.g. lameness, age, or small number of piglets in the first litter. Such an approach of the breeders should be considered a major shortcoming leading to great economic losses.

The weaners and fatteners' index per sow also dependent on the mortality rates of piglets before weaning as well as the number of growers and finishers. The data covering these parameters show that the total losses of pigs in Poland in the period from farrowing to slaughter account for 19.62%. In this respect, there are slight differences between Poland and other EU countries (Austria – 17.5%, Germany – 20.9%, Denmark – 20.7% and an average for EU – 18.3%).

These great differences have an significant impact on pig production costs in Poland and other countries. The reasons for this are complex (Scheidt et al. 1994, Beaulieu et al. 2010, Pastorelli et al. 2011), but low efficiency of reproduction, abandoning of the principle "all-in all-out" as well as significant economic losses due to sub-clinical pig infections can be considered the major ones (Scheidt et al. 1995, Maes et al. 1999).

Underestimation of prophylaxis in reducing the losses caused by wide-spread microorganisms has been well-documented by the data reported by Baekbo et al. (2012). They have reported that in Poland less than 30% of piglets are vaccinated against circovirus diseases, whereas the average in EU is 80%

and in some countries, e.g. in Germany and the Netherlands it accounts for 90%.

The data obtained in the present study indicate that in general, the efficiency of large swine farms is better than that of small ones. This allows us to conclude that the development of large swine herds coinciding with closures of small herds may have been a consequence of these observations. This is likely due to the fact that the owners of large farms are focused exclusively on swine production, while for the owners of small farms it is an extra business, which is of minor importance to them. Besides, it seems that the owners of large herds keen on improving their qualifications and implementing more advanced technologies.

Summarizing, the data obtained in the present study show that in general, Poland is missing reliable and objective data on the efficiency of swine production since they are hardly available from the majority of swine breeders. Average results of swine production efficiency reported by the producers participating in the present investigation proved to be lower than those reported in other EU countries. The greatest differences were observed in the use of the sows' reproductive potential. Large herds (> 200 sows) are more efficient than small herds with 20-49 sows, but even these are less efficient than EU swine herds. Presumably, the performance of the herds smaller than those selected for the study, which are plentiful in Poland, is even worse.

The data obtained in the study show a significant correlation between biosecurity on the farms and production results. The data are in agreement with those reported earlier by other authors (Scheidt et al. 1995, Ribbens et al. 2007, Stanković et al. 2010)

The analysis of such factors like: recording of the data on swine farms, biosecurity, implementation of replacement sows in the main herd, introduction of the principle "all-in all-out" allows us to conclude that inefficient swine production on the majority of Polish farms is the main cause of unprofitable production in most farrow to finish pig herds.

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